



## PIER Energy-Related Environmental Research

Environmental Impacts of Energy Generation, Distribution and Use

### Groundwater Contributions to Baseflow in the Merced River: Processes, Flow Paths, and Residence Times

**Contract #:** 500-02-004-WA MR-043-07

**Contractor:** University of California, Merced

**Contract Amount:** \$75,000

**Contractor Project Manager:** Dr. Martha H. Conklin

**Commission Project Manager:** Gina Barkalow

**Commission Contract Manager:** Beth Chambers

#### The Issue

Information about baseflow is critical for reservoir operations and aquatic ecosystem management, both of which are part of hydroelectric generation planning and operations. Present knowledge of mountain-block hydrology<sup>1</sup> is insufficient for accurate estimation and modeling of the Sierra Nevada water balance, especially during dry years. As climate warming continues, it is urgent to improve our understanding of mountain-block hydrology and to provide better information to water resource and hydroelectric managers about the implications of likely climatic and hydrologic shifts. This project addresses that need by developing promising new scientific concepts concerning groundwater contributions to baseflow in the Merced River, a representative river draining the Sierra Nevada.



C. Marie Denn, National Park Service

**The upper Merced River watershed encompasses approximately 114,840 acres (181.9 square miles) above Happy Isles in upper Yosemite Valley.**

#### Project Description

The objectives of this project are (1) to understand the processes that link snowmelt and rainfall to mountain-block recharge and baseflow, using established and innovative techniques, and (2) to estimate the groundwater contribution to baseflow and its impact on reservoir operations during low-frequency droughts.

The project will integrate field, laboratory, and tracer-based modeling through a collaborative effort led by the University of California, Merced. Fieldwork will be conducted in the Merced River from spring 2006 to 2007. Groundwater residence times will be determined using radiogenic isotopes and noble gases. Stable isotopes of the water molecule will be used to

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<sup>1</sup> Mountain-block hydrology is the hydrology for the entire mountain-block system, from the slope of the highest peak to the deepest recirculating groundwater. This study focuses on the water infiltrating the mountain block and discharging into the upper Merced River.

determine the source waters of baseflow and to understand the links between snowmelt/rainwater and groundwater.

A conceptual model of source waters and flow paths will be developed to assess the temporal and spatial variability of mountain-block recharge and their contribution to the baseflow. This model may lay the foundation to expand such research over the entire Sierra Nevada. It may also lead to a quantitative model to link atmospheric factors with baseflow, and thus to predict baseflow response to climate warming.

### **PIER Program Objectives and Anticipated Benefits for California**

This project offers numerous benefits and meets the following PIER program objective:

- **Provide reliable energy.** The new knowledge developed in this project will be of interest to water resource managers, hydroelectric managers, and environmental policy makers, as well as the broader scientific community. Direct benefit will go to the Federal Energy Regulatory Commission and the California Department of Water Resources, helping them plan hydroelectricity strategy for California, including dam relicensing.

### **Final Report**

PIER-EA staff intend to post the final report on the Energy Commission website in fall 2007 and will list the website link here.

### **Contact**

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